

What is claimed is:

- 1           1.     A storage device comprising:  
2                 a probe; and  
3                 a substrate comprising a storage medium and heating elements,  
4                 the heating elements adapted to heat respective regions of the storage medium  
5     to form perturbations in the respective regions of the storage medium,  
6                 the probe adapted to detect the perturbations.
- 1           2.     The storage device of claim 1, wherein the perturbations comprise dents, and  
2     wherein the probe is adapted to form dents during write operations in regions of the storage  
3     medium that have been heated by respective heating elements.
- 1           3.     The storage device of claim 2, wherein the storage medium has plural storage  
2     cells made up of the respective regions of the storage medium, the heating elements being  
3     associated with respective storage cells.
- 1           4.     The storage device of claim 3, further comprising select lines to select one or  
2     more of the heating elements,  
3                 the select lines to activate at least one of the heating elements to heat a region  
4     of the storage medium corresponding to one of the storage cells to perform one of writing and  
5     erasing.
- 1           5.     The storage device of claim 4, wherein the select lines are provided in the  
2     substrate.
- 1           6.     The storage device of claim 5, wherein the substrate further comprises a first  
2     layer containing a first set of select lines, and a second layer containing a second set of select  
3     lines.

1           7.     The storage device of claim 3, wherein the heating elements are adapted to  
2     heat respective storage cells to erase data stored by the storage cells.

1           8.     The storage device of claim 1, wherein the substrate comprises a layer making  
2     up the storage medium, the layer between the probe and the heating elements.

1           9.     The storage device of claim 8, wherein the layer is formed of a material  
2     containing polymer.

1           10.    The storage device of claim 8, wherein a selected one of the heating elements  
2     is adapted to melt a region of the layer to enable the probe to form a dent in the melted  
3     region.

1           11.    The storage device of claim 1, wherein the heating elements comprise resistive  
2     elements.

1           12.    The storage device of claim 1, wherein the storage medium has plural storage  
2     cells made up of respective regions of the storage medium, wherein each of the heating  
3     elements is adapted to heat a respective group of plural storage cells.

1           13.    The storage device of claim 1, wherein the heating elements are adapted to  
2     deactivate to cool the respective regions of the storage medium, wherein a rate of cooling of  
3     the respective regions of the storage medium affects the crystallinity of the respective  
4     regions.

1           14.    The storage device of claim 13, wherein deactivation of a first heating element  
2     to cool a first region of the storage medium at a first rate causes the first region to have an  
3     amorphous structure, and wherein deactivation of a second heating element to cool a second  
4     region of the storage medium at a second, slower rate causes the second region to have a  
5     crystalline structure.

1           15.    The storage device of claim 14, wherein the probe is adapted to detect the  
2   amorphous structure of the first region and the crystalline structure of the second region  
3   based on detected resistances associated with the first and second regions, wherein the  
4   crystalline structure has a lower resistance than the amorphous structure.

1           16.    The storage device of claim 1, wherein the perturbations comprise bumps  
2   formed above a surface of the storage medium, the bumps caused by heating of respective  
3   heating elements.

1           17.    A system comprising:  
2                   a processor; and  
3                   a storage device comprising:  
4                         a probe, and  
5                         a substrate comprising a storage medium and heating elements, the  
6   storage medium having plural storage cells,  
7                         the heating elements adapted to heat respective storage cells for  
8   programming the storage cells,  
9                         the probe adapted to read storage cells.

1           18.    The system of claim 17, wherein the probe is adapted to be scanned across a  
2   surface of the storage medium to read the storage cells.

1           19.    The system of claim 18, wherein the storage device further comprises an  
2   actuator to move the substrate to cause scanning of the probe across the surface of the storage  
3   medium.

1           20.    The system of claim 19, further comprising a probe substrate on which the  
2   probe is formed, the probe substrate further comprising additional probes to read the storage  
3   cells.

1           21.     The system of claim 17, wherein heating by the heating elements causes  
2 perturbations to be formed in storage cells that are heated,  
3                 wherein the probe is adapted to detect the perturbations to determine a data  
4 state.

1           22.     The system of claim 21, wherein the probe is adapted to form a dent in a  
2 storage cell that has been heated by a corresponding heating element.

1           23.     The system of claim 22, wherein the heating element is adapted to melt a  
2 region of the storage medium corresponding to a storage cell to enable the probe to imprint a  
3 dent into the melted region.

1           24.     The system of claim 17, wherein the heating elements comprise resistive  
2 elements.

1           25.     The system of claim 24, wherein the storage device further comprises select  
2 lines to activate the resistive elements, and  
3                 peripheral circuitry to activate the select lines.

1           26.     The system of claim 25, further wherein the select lines comprise electrically  
2 conductive traces in the substrate.

1           27.     The system of claim 17, wherein the probe has a tip to interact with a heated  
2 region of the storage medium to form a respective perturbation during a write operation.

1           28.     The system of claim 17, wherein the heating elements are adapted to heat  
2 respective storage cells to erase the storage cells.

1           29.     The system of claim 19, wherein the probe comprises a nanotechnology probe.

1           30.    A method of storing data in a storage device, comprising:  
2                    activating heating elements provided in a substrate to heat respective regions  
3 of a storage medium that is formed in the substrate;  
4                    forming perturbations in regions of the storage medium by heating the selected  
5 regions with respective heating elements; and  
6                    detecting the perturbations with a probe.

1           31.    The method of claim 30, wherein activating the heating elements comprises  
2 activating resistive elements.

1           32.    The method of claim 31, wherein activating the resistive elements comprises  
2 causing electrical current to conduct through the resistive elements.

1           33.    The method of claim 29, wherein forming the perturbations comprises forming  
2 dents.

1           34.    The method of claim 29, wherein forming the perturbations comprises forming  
2 bumps.

1           35.    The method of claim 39, wherein forming the perturbations comprises forming  
2 at least one of an amorphous structure and a crystalline structure in a selected region of the  
3 storage medium.